

Draft

Avian and Bat Monitoring Plan for the Martinsdale Wind Farm

Wheatland County, Montana

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INTRODUCTION AND BACKGROUND

The Martinsdale Wind Farm (the “Project”) is being proposed for development in Wheatland County, Montana northeast of the town of Martinsdale. Baseline studies (Hazelwood 2007) and review of existing information from other wind projects were used to estimate the impacts of the project on wildlife, including birds and bats. The proposed development will be a maximum of 300 MW, with the first Phase likely consisting of a maximum of 57 MW and 27 turbines. The future characteristics of future phases of the project will depend on factors such as turbine model, electricity markets, and transmission constraints. The Project developer will fund an operational monitoring program to directly estimate the impacts of the windfarm on birds and bats.

The operational monitoring plan for the Project will consist of the following components:

- 1) Intensive fatality monitoring, for a minimum of two years of the Phase I project and a minimum of one year for the Phase II site, using standardized carcass searches and carcass removal and searcher efficiency trials; and a protocol for handling and reporting of fatalities and injured wildlife for the life of the project;
- 2) Surveying, for a minimum of two nesting periods post-construction, for golden eagle and ferruginous hawk nests and nest success within 2 miles of the Phase I and II wind turbines;
- 3) Using a Technical Advisory Committee of the various stakeholders to review methodologies and results and make recommendations regarding the need for changes to the existing methods and the need for additional monitoring beyond the effort described in this plan.

The protocol for the fatality monitoring study is similar to protocols used at the Vansycle Project in northeastern Oregon (Erickson *et al.* 2000), the Stateline project in Oregon and Washington (FPL *et al.* 2001, Erickson *et al.* 2003a), the Buffalo Ridge project in southwestern Minnesota (Johnson *et al.* 2000), the Wild Horse Wind Project in Washington (Erickson *et al.* 2008), and the Foote Creek Rim project in Wyoming (Young *et al.* 2003) and Judith Gap Project (Erickson *et al.* 2004). The scope of responsibility of the existing Technical Advisory Committee (TAC) established for the Judith Gap Windfarm is proposed to be expanded to include the Martinsdale project. The TAC will evaluate the methods and results of the monitoring program, and make recommendations regarding the need for changes to the existing plan, including the need for additional monitoring. Representatives on the

TAC include the developer, Northwestern Energy, the U.S. Fish and Wildlife Service (USFWS), Montana Fish, Wildlife and Parks (MFWP), Montana Department of Natural Resources and Conservation (DNRC), Montana and Yellowstone Audubon and Montana Grouse Partnership and consultants conducting the monitoring studies.

AVIAN AND BAT FATALITY STUDY

Introduction

The primary objective of the fatality studies is to estimate the annual number of avian and bat fatalities attributable to the Project. The standardized fatality monitoring phase of the study will begin once all the turbines are constructed and operational. The study will be conducted for a minimum of one year, with a less intensive monitoring program (incidental monitoring) in place for the life of the project, including during the construction phase. The methods are broken into four primary components: 1) standardized carcass searches, 2) an incidental casualty and injured bird reporting system, 3) searcher efficiency trials, and 4) carcass removal trials.

The number of avian and bat fatalities attributable to collision with the wind turbines will be estimated based on the number of avian and bat fatalities found in the casualty search plots whose death appears related to collision with these structures. All carcasses located within areas surveyed, regardless of species, will be recorded and a cause of death determined, if possible, based on inspection of the carcass. Some carcasses may be necropsied to aid in determining cause of death. Total number of avian and bat carcasses will be estimated by adjusting for "removal bias" (e.g., scavenging), searcher efficiency bias, and sampling effort. Carcasses where the cause of death is not apparent will be included in the fatality estimate. Including fatalities when cause of death is unknown will lead to an overestimate of the true number of wind project fatalities. Most projects have used this conservative approach (e.g., Foote Creek Rim, Wyoming; Vansycle, Oregon; and Stateline, Oregon and Washington) because of the relative high costs associated with obtaining accurate estimates of natural or reference mortality.

Definitions and Field Methods

Selection and Delineation of Carcass Search Plots

A sample of half the Phase I turbines will be selected using a systematic sampling procedure with a random starting point for selection of the first turbine. Sampling effort for future expansions of the project will be determined based on the results of the monitoring for Phase I. Square plots a minimum distance of 100 m from the turbines and centered on the turbine will be searched by walking parallel transects. Plots will be orientated so that the maximum distance searched (141 m) will coincide with the general direction of the prevailing winds (Figure 1). Adjustments to the plot size may be made prior to searches once the dimensions of the turbine (i.e., height and rotor diameter) are known. Studies at the Vansycle wind plant (Erickson *et al.* 2000), the Buffalo Ridge wind plant (Johnson *et al.* 2002, Higgins *et al.* 1996), the Foote Creek Rim wind plant (Young *et al.* 2003), and the Nine Canyon Wind Project (Erickson *et al.* 2003b) indicate nearly all fatalities are found within the tip height distance measured along the ground from the base of the turbines, with a large majority of bat carcasses found within a distance equal to 50% of the tip height.

Scheduling/Timing

Carcass searches will be conducted approximately once every week¹ at the sampled turbines from March 15th – November 31st. One search will be conducted in January focusing on documenting large raptors such as bald eagles or golden eagles which are highly visible and are typically not removed by scavengers. The first search will be conducted within 30 days after the date all turbines become operational (commercially producing electricity) to clear the plots of evidence of old carcasses and document fatalities that may have occurred during the testing and early operational phase. Approximately 38 searches will be conducted at half the Phase I turbines during the first monitoring year. The other half of turbines will be sampled the 2nd

¹ this schedule may be modified depending on the results of the carcass removal trial. The first trial will be conducted during the construction period.

monitoring year.

Standardized Carcass Searches

Objective: to systematically search the Project for avian and bat fatalities that are attributable to collision with project facilities.

Personnel trained in proper search techniques will conduct the carcass searches. Initially, transects will be set approximately 6-10 meters apart in the area to be searched. A searcher will walk at a rate of approximately 45-60 meters a minute along each transect searching both sides out to three meters for casualties. Search area and speed may be adjusted by habitat type after evaluation of the first searcher efficiency trial. We anticipate that it should take approximately 2.5 hours to survey the search area around each turbine depending on habitat type.

The condition of each carcass found will be recorded using the following condition categories:

- Intact – a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- Scavenged – an entire carcass, which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.).
- Feather Spot - 10 or more feathers or 2 or more primaries at one location indicating predation or scavenging.

Appendix A contains examples of various field and laboratory forms for the carcass searches and fatalities discovered. All carcasses found will be labeled with a unique number, bagged and frozen for future reference and possible necropsy. A copy of the data sheet for each carcass will be maintained, bagged and frozen with the carcass at all times. For all casualties found, data recorded will include species, sex and age when possible, date and time collected, GPS location, condition (e.g., intact, scavenged, feather spot), and any comments that may indicate cause of death. All casualties located will be photographed as found and mapped on a detailed map of the study area showing the location of the wind turbines and associated facilities such as access roads and meteorological towers.

Casualties or fatalities found by maintenance personnel and others not conducting the formal searches within 150 m of a wind turbine, meteorological tower, substation or road will be documented using a wildlife incident reporting system (see WRRS section below). Collection of state or federal endangered, threatened, or protected species will be coordinated with the USFWS and MFWP. When non-study personnel discover carcasses or injured animals, a digital photograph will be taken, and a Project Respondent² will be notified to identify the casualty. Personnel potentially involved in searches will receive training prior to working in the Project. Casualties or fatalities found in non-search areas will be treated as incidental discoveries. Fatalities found within search areas, but not during scheduled searches, will be included in the fatality estimation.

Any injured native birds found will be carefully captured by a trained technician and transported to the designated wildlife rehabilitation center or veterinary clinic in a timely fashion. An example protocol for handling injured birds is found in Appendix B and will be used for this project. Appropriate collection permits will be obtained from the MFWP and the USFWS. Dissemination of data (e.g., to the USFWS law enforcement and other agency representatives) is discussed in the "Disposition of Data" section below.

Searcher Efficiency Trials

Objective: to estimate the percentage of avian/bat fatalities which are found by searchers.

Searcher efficiency studies will be conducted in the same areas carcass searches occur. Searcher efficiency will be estimated by size of carcass, general habitat type, and season. Estimates of searcher efficiency will be used to adjust the number of carcasses found, correcting for detection bias.

Searcher efficiency trials will begin when turbines are placed into operation. Personnel conducting the searches will not know when trials are conducted or the location of the detection carcasses.

² a person trained in the monitoring program and who is listed on the state and federal scientific collection permits

During each season approximately 15 carcasses of birds of two different size classes will be placed in the search area throughout the search period, for a total of approximately 120 searcher efficiency trial carcasses for the entire year. Species such as house sparrows and European starlings will be used to represent small-sized birds. Species such as rock pigeons, hen mallards and hen pheasants will be used to represent medium to large-sized birds. A minimum of two dates will be used each season for a minimum total of 8 trial dates. An attempt will be made to use several small brown birds (house sparrows) during the summer and fall seasons to simulate bat carcasses. Bat carcasses will be used if available.

All carcasses will be placed at random locations within areas being searched prior to the carcass search on the same day. If avian scavengers appear attracted by placement of carcasses, the carcasses will be distributed before dawn. Carcasses will be dropped from waist height.

Each trial carcass will be discreetly marked so that it can be identified as a study carcass after it is found. The number and location of the detection carcasses found during the carcass search will be recorded. The number of carcasses available for detection during each trial will be determined immediately after the trial by the person responsible for distributing the carcasses.

Wildlife Response and Handling System and Incidental Fatality Discoveries

The Wildlife Response and Handling System (WRHS) is a monitoring program set up for searching for and handling avian casualties found by maintenance personnel. Construction and maintenance personnel will be trained in the methods. This monitoring program includes reporting of carcasses discovered incidental to construction and maintenance operations.

Any carcasses discovered by maintenance personnel will be recorded, photographed and reported to a Project Respondent. The Respondent will identify the fatality and fill out the Casualty Information Form (see Appendix A). The fatality will be collected unless it is a federal endangered or threatened species. If the fatality is a federally listed species, the USFWS will be contacted for handling instructions. Fatalities discovered on standardized carcass search plots but not during scheduled searches will be included in the fatality estimates.

Carcass Removal Trials

Objective: to estimate the length of time avian/bat fatalities remain in the search area.

Carcass removal studies will be conducted during the construction period and throughout the monitoring year. Estimates of carcass removal will be used to adjust carcass counts for removal bias. Carcass removal includes removal by predation or scavenging, or removal by other means such as being plowed into a field.

It is expected that carcass removal trials will occur within each of the following seasons, but times for these trials may vary: (1) spring migration (March 16 - May 31); (2) breeding season (May 31-August 15); (3) fall migration (August 16-November 30th). Planted carcasses are not placed in or near the carcass search plot because they might be confused with wind turbine related fatalities. The planted carcasses will be located randomly within the carcass removal trial plots. If only a percentage of the turbines are searched, turbine locations not selected for searching will be used for the trials. If all turbines are searched, trials will be conducted in areas near the turbines with similar habitats.

Each season, approximately 15 carcasses of birds of two size classes will be distributed resulting in a total of approximately 120 trial carcasses used in carcass removal studies for the entire year for the entire wind project. Species such as house sparrows and European starlings will be used to represent small-sized birds. Species such as rock pigeons, hen mallards and hen pheasants will be used to represent medium to large-sized birds. Approximately 7 or 8 carcasses from each size class (15 total carcasses) will be placed in the field during each of at least two trials each season. Thus, the trial will be spread throughout the year to incorporate the effects of varying weather, climatic conditions, farming practices, and scavenger densities. If fresh bat carcasses are available, they may also be used. Carcasses will be dropped from waist height.

It is expected that carcasses will be checked as follows, although actual intervals may vary. Carcasses will be checked for a period of 20 days to determine removal rates. They will be checked every day for the first 4 days, and then on day 7, day 10, day 14, and day 20. This schedule may vary depending on weather and coordination with the other survey work.

Experimental carcasses will be marked discreetly using a piece of tape on one leg for recognition by searchers and other personnel. Experimental carcasses will be left at the location until the end of the carcass removal trial. Any remaining trial carcasses will be removed at the end of the 20-day period.

Data Handling and Statistical Analysis Methods For Fatality Data

The estimate of the total number of wind turbine-related fatalities will be based on three components: 1) observed number of carcasses, 2) searcher efficiency expressed as the proportion of planted carcasses found by searchers, and 3) removal rates expressed as the length of time a carcass is expected to remain in the study area and be available for detection by the searchers.

Observed Number of Carcasses

The average number of carcasses detected per turbine is:

$$\bar{c} = \frac{\sum_{i=1}^k c_i}{k}$$

where c_i is the number of carcasses detected at turbine i for the period of study, and k is the number of turbines searched.

Estimation of Searcher Efficiency

Searcher efficiency is expressed as p , the estimated proportion of trial carcasses found by searchers.

The variance of the estimate, $v(p)$, is calculated by the formula:

$$v(p) = \frac{p(1-p)}{d}$$

where d is the total number of carcasses placed. Carcass detection rates will be estimated by major habitat type, carcass size, and season. Data will be pooled across seasons if detection rates are not significantly different between seasons.

Estimation of Carcass Removal

Estimates of carcass removal are used to adjust carcass counts for removal bias. Carcass removal includes removal by predation or scavenging, or removal by other means such as being plowed into

a field. The length of time a carcass remains in the study area before it is removed is denoted as t_i . Mean carcass removal time is expressed as \bar{t} , the average length of time a carcass remains at the site before it is removed:

$$\bar{t} = \frac{\sum_{i=1}^s t_i}{s}$$

where s is the number of carcasses used in the scavenging trials. Modifications to the estimator will be made if there are trial carcasses that remain at the end of the 20-day trial period (Barnard 2000, Erickson *et al.* 2003a, Shumway *et al.* 1989).

Estimation of the Total Number of Facility-Related Fatalities

To calculate the total number of facility-related fatalities (M), the observed fatality rate is divided by $\hat{\pi}$, an estimate of the probability a casualty is not removed by a scavenger (or other means), and is detected:

$$M = \frac{N * \bar{c}}{\hat{\pi}}$$

Where $\hat{\pi}$ is an estimate of the probability a carcass is available to be detected and is detected (Erickson *et al.* 2004, Huso 2008). We denote m as the estimated mortality per turbine per year (M/N). Other modifications may be made with approval from the TAC.

We will calculate annual fatality estimates for raptors, small birds, large birds, all birds combined and bats. The final reported estimates of m and associated standard errors and 90% confidence intervals will be calculated using bootstrapping (Manly 1997) based on a computer program written in SAS. For each iteration of the bootstrap, the turbines and associated mortality data, searcher efficiency trial birds and associated data, and the scavenging removal trial birds and associated data are sampled with replacement. Estimates of \bar{c} , \bar{t} , p , and m are calculated for each of 5,000 bootstrap samples. The final estimates of \bar{c} , \bar{t} , p , and m , and associated bootstrap percentile confidence intervals, are calculated from the 5,000 bootstrap estimates.

RAPTOR NEST STUDY

The primary objective of raptor nest surveys is to document and monitor active ferruginous hawk and golden eagle nests located within 2 miles of the wind turbines. This information will aid in understanding whether operation of the facility results in a reduction of nesting activity or nesting success. One aerial survey and a minimum of two ground surveys will be conducted in April and May to determine occupancy and nest success statistics of golden eagle and ferruginous hawk nests within 2 miles of Phase I turbines. The developer will share the data with state and federal biologists. Raptor nests will be monitored for a minimum of two breeding seasons during operation of all phases of the windfarm. All nests will be given identification numbers, and nest locations will be recorded on U.S. Geological Survey 7.5 minute quadrangle maps. Global positioning system (GPS) coordinates will be recorded for any new nests not previously recorded. Locations of inactive nests will be recorded. All new nests not previously mapped, whether active or inactive, will be given an identification number and their locations (coordinates) recorded. For occupied golden eagle and ferruginous hawk nests within 2 miles of the wind turbines, nesting success will be determined by a minimum of one ground visit (if land access is granted) to verify species, number of young and nesting success. A successful nest means that the young have successfully fledged (flown from the nest).

DISPOSITION OF DATA AND DECISION STANDARDS

This monitoring program will provide data for evaluating the direct impacts of the Project on birds and bats from mortality studies, and the indirect impacts of the Project on breeding grassland birds and nesting raptors. A Technical Advisory Committee (TAC) will be established to evaluate the results of the monitoring program and make recommendations regarding additional monitoring.

Representatives on the TAC include the developer, Northwestern Energy, the U.S. Fish and Wildlife Service (USFWS), Montana Fish, Wildlife and Parks (MFWP), Montana Department of Natural Resources and Conservation (DNRC), Montana and Yellowstone Audubon and Montana Grouse Partnership and consultants conducting the monitoring studies. At a minimum, The TAC will meet after completion of one year of the monitoring program to discuss the results of the

monitoring studies, evaluate the methods used, and address the need for further study. Additional meetings may be held during the monitoring years to address problems or issues identified during the study. The wind project developer will provide progress reports in the form of a technical memorandum to the TAC every three months that will include data pertaining to any avian and bat fatalities discovered to date, as well as data from other study components. The USFWS Resident-Agent-In-Charge (RAC, Roger Parker, 406.247.7355) will also be notified within 24 hours of positive identification of any endangered or threatened species fatality. An annual report will be prepared at the end of the first year of monitoring and will be distributed to the members of the TAC at least one week prior to the annual meeting. The need for further study or changes to the current protocol will be based on reasonable criteria proposed by the TAC. The TAC should consider the following information in their recommendations regarding the need for further study.

Judgments regarding the level of mortality warranting further study must be subjective. The criteria for recommending further study should use a common sense "weight-of-evidence" approach to determine the effects of the Project on species of concern. The weight-of-evidence approach will consider the number of carcasses actually found, the magnitude of mortality events, the estimate of the total number of carcasses, the precision of the estimates, the relative abundance of the species based on the baseline and monitoring studies, results of similar studies in the region, and legal and social issues.

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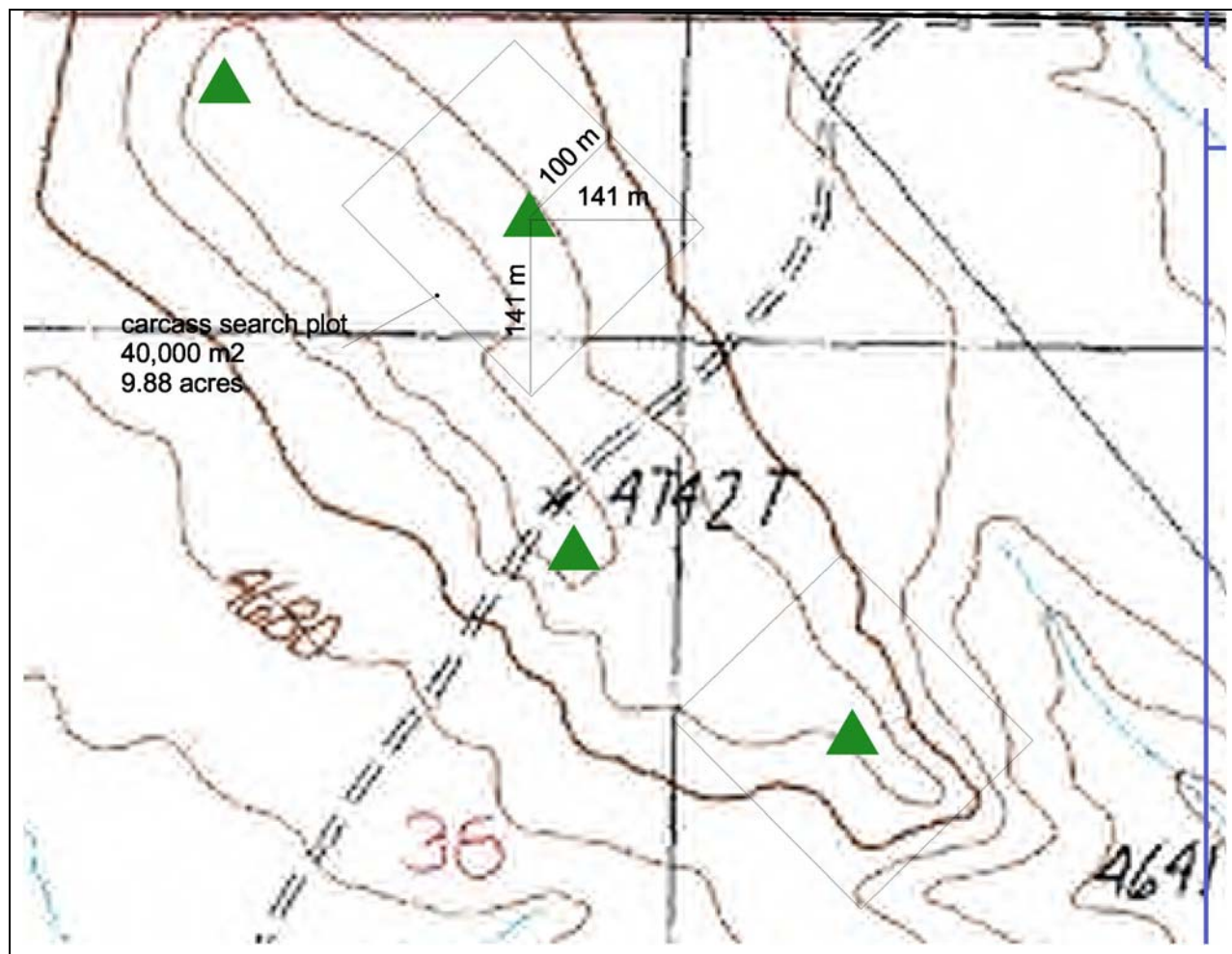


Figure 1. Approximate size and orientation of the carcass search plots.

**APPENDIX A CARCASS SEARCH AND SEARCHER EFFICIENCY TRIAL DATA
FORMS**

CASUALTY SEARCH FORM-keep with carcassMartinsdale **Wind Farm**

DATE: _____ OBSERVER: _____

PLOT TYPE (circle one): turbine met tower powerline other PLOT NO.: _____

TIME BEGIN: _____ TIME END: _____

CASUALTIES FOUND:

SPECIES	SAMPLE NO.	HABITAT
_____	_____	_____
_____	_____	_____
_____	_____	_____

SEARCHER EFFICIENCY CARCASSES FOUND:

SPECIES	ID TAG	HABITAT
_____	_____	_____
_____	_____	_____

CASUALTY INFORMATION FORM - FIELD FORM

Martinsdale **Wind Farm**

DATE: _____ TIME: _____ OBSERVER: _____

FOUND DURING (check one): SCHEDULED CARCASS SEARCH _____ INCIDENTAL FIND _____

COLLECTED? Yes No SAMPLE NO.: _____ FILM ROLL/PHOTO NO: _____

PLOT TYPE (circle one): turbine met tower powerline other PLOT NO.: _____

LOCATION IF NOT ON PLOT _____

HABITAT: _____

SPECIES: _____ SEX(circle): M F U AGE(circle): A J U

CONDITION (circle one): injured intact scavenged dismembered feather spot other

DISTANCE & BEARING FROM NEAREST TOWER/POLE:

DESCRIPTION DISTANCE (m) BEARING (degrees)

Part 1 _____

Part 2 _____

Part 3 _____

Other _____

Comments:

ESTIMATED TIME SINCE DEATH/INJURY: _____

WEATHER HISTORY [If carcass is estimated to be less than one week old, circle any of the following weather conditions that occurred at or before the estimated time of death/incident]:

clear calm fog cloudy rain snow storm gusty wind violent storm blizzard

WEATHER NOTES:

GENERAL COMMENTS: (e.g. behavior observed if bird is injured; details of carcass - body parts missing, injuries, number of feathers in feather spot; indications of cause of death, field marks for identification, USFWS band no., etc.)

Agency ContactUSFWS Contact: Date: _____ Time: _____ Recovery Approval: yes
no

Contact Person(s):

Comments:

Disposition of Find _____

Transported to freezer _____ Date: _____ Time: _____

Release to USFWS: Person: _____ Date: _____ Time: _____

Comments: _____

Searcher Efficiency Trials: Carcass Placement Log

Martinsdale *Wind Farm*

General Information: Season_____ Month_____ Other_____

No.	Species/Age	Placed By	Date	Time	Plot: Location	Found? (yes/no)	Retrieved? (yes/no)	Notes
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Weather notes for days that carcasses are placed:

Date_____ Time_____ Temp_____ Wind Dir._____ Wind Speed_____ Precip_____

Date_____ Time_____ Temp_____ Wind Dir._____ Wind Speed_____ Precip_____

Date_____ Time_____ Temp_____ Wind Dir._____ Wind Speed_____ Precip_____

Date_____ Time_____ Temp_____ Wind Dir._____ Wind Speed_____ Precip_____

APPENDIX B - INJURED WILDLIFE – PROCEDURES FOR REPORTING AND CARE

INJURED WILDLIFE – PROCEDURES FOR REPORTING AND CARE

The following procedures apply to injured birds or other wildlife:

Record data on the Casualty Information Form but first, the primary objective is to provide immediate care for the injured animal. Capture animal by placing a dark cloth or blanket over the animal. By removing its ability to see, generally it will calm down and be more easily handled. Place the animal in a box that has a towel or other material for the animal to hide under or grasp on to.

Quickly look around the immediate area for other injured animals as there may have been a flock, or a pair.

While capturing the animal, assess the injury so you'll know what to report to the wildlife rehabilitator or veterinarian.

Do not provide additional stress. Keep cool if it is a hot day and keep it slightly warm if it is a cool day by placing the box in the office. Darken room if possible.

If it is a federally listed (Threatened, Endangered) or Montana State listed (Threatened, Endangered) species, a Project Respondent will contact Montana Fish Wildlife and Parks (Alison Puckniak, 406.247.2966). In addition, for federally listed species, they will contact U.S. Fish and Wildlife Service Law Enforcement Resident-Agent-in-Charge (RAC, Roger Parker, 406.247.7355). These calls should be made within 24 hours of discovery. Phone the designated rehabilitation center for additional instructions. Describe the injury to the rehabilitation center and they will determine if it should go directly to a veterinary clinic.

Deliver the animal to the specified location. The doctor will need to fill out the "Casualty Examination Form." The clinic will make arrangements to deliver the animal to the designated rehabilitation center. The owner of the wind project will pay for all veterinary bills.